MONETARY VALUATION OF THE ENVIRONMENTAL OUTPUT FOR VISITORS TO THE FORESTS OF THE NORTH ATLANTIC COAST ON THE IBERIAN PENINSULA

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I — Introduction

The most singled out feature of woodlands in Galicia and Northern Portugal is the continuous increase of eucalyptus *(Eucalyptus Globulus)* plantations. Since the 1960s this species has expanded to cover over 270,000 ha in Galicia and 695,000 ha in Portugal, that is 29% and 21% of the total forested areas respectively. As a result that fast growing conifers and eucalyptus now cover 90% of the woodlands and 40% of the overall territory. In some districts, the percentage increased up to 49%. In 1995 these plantations were 150,000 ha larger than the targets set by the administration. This brings about very short rotations and monotony to the landscape, as opposed to the diversity provided by deciduous species in the forests. Other features are the fact that there are many areas that totally lack any agricultural, cattle or forest use; that there are many forest fires, with an average area burnt down annually between 1990 and 1995 of 1.2% of open or forested spaces; and much random clearcutting.

From an economic standpoint, these facts are determinant to the sector's output, both as regards actual timber harvested and the implications on further industrial production processes and on the social function of forests as public assets and their external effects. These effects are protection against snow avalanches or topsoil erosion, wind speed, temperature, quality and quantity of water supplies, carbon fixing, spaces to develop recreational and leisure activities, as well as habitat for much wildlife and flora. There may also be negative external effects, such as those brought about by the loss of landscape, flora and wildlife that are associated to random plantations.

The public intervention in this sector is traditional in industrialised countries and increasing in Europe with the CAP reform. If the intervention aims at maximising social well being then both aspects, market and non-market, should be taken into account. We do not know of any studies that value the social function of these forests. It is recognised that benefits are location- and system-

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specific, and that how forestry is done matters more than whether forestry is done. To find out how much net benefit arises from current forests management and how much would arise with another type of forest or forestry policy (favouring long rotations and broad-leaved species) non-market benefits must be taken into account

Thus, there may be a need to try to place money value on the benefits so that providers can better decide whether to maintain one existing forest or to improve it. Since there is no market associated to these functions, contingent valuation (CV) is used to estimate benefits. Numerous applications to non--market goods and services demonstrate the validity of the technique. This methodology constructs a hypothetical market in which sample respondents reveal their willingness to pay (WTP) to avoid, or willingness to accept (WTA) contingent on a quantitative or qualitative change in the resource of interest. Elicited responses are theoretically equivalent to a measure of compensating or equivalent variation since they reveal sums respondents would surrender to maintain utility rather that derived from an inferior provision of the resource. The major advantage of the method is that the respondent does not have to be a user of the resource in question. The technique is handicapped wherever the good to be valued is difficult to explain or unknown to respondents, or where respondents have little experience in making similar transactions. Much controversy surrounds the technique, both in terms of its ability to deliver reliable estimates of WTP or WTA and the correct design of CVM surveys. Critical design issues are bidding formats (open versus open-ended) and the level of information provision. CV has also been criticised for suffering from bias, that is, systematic over- or understatement of true WTP (WTA). Possible sources of such bias are starting point in bidding games, the choice of bid vehicle, the hypothetical market, embedding or mental accounting. The US Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) convened a panel of distinguished economists thought to have no vested interest in the CVM to conduct hearings on the validity of the CV method in 1992. The Panel's report on their findings was basically a cautious acceptance of CV (Arrow et al.,1993). The principal recommendations are that a In-person interviews should be employed; WTP (not WTA) should be sought, WTP estimates should be sensitive to the scope (scale) of environmental change, respondents should be reminded of their budget constraints, a dichotomous choice format should be used, a minimum response rate from the target sample of 70 per cent should be achieved and the CV results should be calibrated against experimental or actual market findings.

In what follow, we first introduce the area relevant to our case study, and the conceptual framework followed. Then, we present our results. Finally, we carry out an interpretation and discussion of our results.

II — The empirical study

II.1 — The forest valued

This paper reports on data obtained with regard to a 20,000 ha area of which 3.7 per cent has been declared a natural park (746 ha). There are no noteworthy wildlife species, and the situation is representative of woodlands in Galicia and Northern Portugal (Inventario de recursos Baixo Miño, 1992). The woods are made up of eucalyptus and conifers plantations. Deciduous species make up 0.5 per cent of that area. Treeless lands represent 20 per cent. During the period from 1982 to 1993, there were on average 155 forest fires per annum that burnt down 4 per cent of the land, of which 79 per cent were covered by trees. Forest use inside the natural park (longer turnover, lesser density of trees and greater diversity of species) as well as the existence of infrastructures for the pursuance of leisure activities are an exception in the case of Galician forests, whereas elsewhere in Europe they may be the norm. The natural park area did not suffer from wildfires in the period studied. According to the classification of the FAO, its recreational use is important since it receives visits over ten days per ha/year. 36 per cent of visitors are residents of the five municipalities in the district where the natural park is located, 33 per cent in Vigo (the major nearby urban centre), 17 per cent in the rest of Galicia and the remainder are residents of other parts of the Iberian Peninsula, mostly from Portugal, Madrid and Barcelona.

II.2 — The concepts of value

The research objective was to estimate the value that the 20,000 ha area my provide. Visitors obtain satisfaction visiting the 746 ha natural park (NPA). The NPA may also provide satisfaction to non-visitors and the rest of the 20,000 ha non-visited woodlands may also provide satisfaction to visitors and non-visitors. The last benefits are associated with the knowledge that certain social functions are maintained (erosion control, water quality, CO_2 stores, wildlife habitat) and from the reassurance that future visits may take place.

Budget constraints to the realisation of the application do not allow us to take both the non-visitor and visitor population into account. There are some advantages, however, in considering the visitor population. They are in contact with the object being valued and this decreases the degree of uncertainty, chance replies and the effort necessary to respond; efficiency increases and furthermore, relevant information may be obtained about the way visitors make use of the services provided. The main disadvantage of this procedure is that we only estimate benefits for visitors or one part of the total non-market output of the considered woodlands.

We estimate the follow three values:

1) Value of the visits made to the 746 ha of the natural park (NPA);
2) The satisfaction that visitors may obtain from improved landscapes, that is increasing the presence of deciduous species into the natural park, such as oak *(Quercus robur),* beech *(Fagus sylvatica)* and sweet chestnuts *(Castanea sativa);*
3) The benefits to the visitors to the park from implementing measures to preserve from intensive use or reforest areas having suffered from wildfire or clearcutting without re-planting. We take the 20,000 ha of the district into account. The NPA is not representative enough to this purpose, being small in size and enjoying the maximum protection levels applicable in Galicia.

We may not estimate total value and divide into categories given that the different value components refer to different objects. Another reason in favour of this strategy is the advantage of using an entrance fee as a means of payment to enter the NPA that would be less applicable to the overall forestlands in the district. The experience of an entrance fee for a forest lying close to the NPA makes this instrument the more credible for the application.

We assume the visitor derives utility from visits to the NPA Q, the state of quality of the NPA and other woodlands Z, and all other market goods and services $x = (x_1, x_2 \ldots x_n)$, such that $U\ (x, Z, Q)$. For simplicity, assume that all other market goods lead to positive utility and utility increases at a decreasing rate.

The visitor's choice of all market goods and services is constrained by fixed monetary income, Y, and the prices of these goods and services, $p = (p_1, p_2, \ldots, p_n)$.

The visitor selects levels of market goods to maximize utility subject to a fixed level of income and the non-market forest output. Formally:

$$\underset{x}{Max}[U\ (x,Z^0,Q^0) \mid Y \geq px; Z^0, Q^0\ preassigned]$$

Another way to rewrite this is as a cost minimisation problem. The individual selects levels of the market goods to minimise expenditures, subject to a fixed level of utility and the environmental service. Formally:

$$e(p,\ Z^0,Q^0,U^0) = \underset{x}{Min}[px \mid U^0 \geq U\ (x,Z^0,Q^0); Z^0, Q^0\ preassigned]$$

where $e\ (P,Z^0,Q^0,U^0)$ is the expenditure function or minimum expenditure necessary to achieve the fixed level of utility, U^0, dependent on price and the level of Z and Q.

The first value, monetarization of the benefit of «recreational service» as provided by the NPA to the visitors, is estimated through the Equivalent Surplus

(Johansson, 1987; Hanley et al. 1997). Such a measure corresponds to the willingness to pay (WTP) or forsaking income, in order to maintain visit levels Q^0 and post-intervention level of utility U^1 ($U^0 > U^1$).

Formally, given the prices p, the income level Y and the quality of the NPA Q^0, this first change proposed in the questionnaire for the public good from the initial situation 0 to the proposed alternative 1, can be expressed ($Q^0 < Q^1$):

$$U(p, Y\text{-}ES, Z^0, Q^0) = U(p, Y, Z^0, Q^1)$$

where the *ES* is the monetary value equivalent to the loss of utility given rise by the decrease in the visits per annum the visitors want to forgone in order no to give up visiting the park.

By using the expenditure function, the equivalent surplus corresponds to the difference of expenditure for each one of the levels of provision of public service *Q*, i. e.:

$$ES = e(p, U^1, Z^0, Q^1) - e(p, U^1, Z^0, Q^0) = -\int_{Q^0}^{Q^1} \frac{\partial e(p, U^1, Z^0, Q)}{\partial Q}\, dQ$$

For the second value, we propose making deciduous hardwood species dominant in the park. Formally, given the prices p and the income level *Y*, the change proposed for landscape from current level with conifer-eucalyptus plantation Z^0 to broad-leaved species dominance Z^1 can be expressed:

$$U(p, Y, Q^0, Z^0) = U(p, Y\text{-}CS, Q^0, Z^1)$$

where *CS* is the maximum WTP that would bring back the visitor to the original level of utility prior to the improvement U^0.

The expenditure function allows us to establish the income that an individual may be willing to surrender in order to achieve an improved forest, that is:

$$CS = e(p, U^0, Q^0, Z^1) - e(p, U^0, Q^0, Z^0) = -\int_{Z^0}^{Z^1} \frac{\partial e(p, U^0, Z, Q^0)}{\partial Z}\, dQ$$

Finally, measures to preserve or reforest areas increase the utility for the visitors, as deriving from the decreased risk of loss of forested area (Freeman III, 1993). First we assume the possibility that the woodlands of the Baixo Miño, devoted to timber harvesting and not currently used for recreational-landscape purposes, may become forests where preservation goals are implemented in order to sustain the current situation.

Let Z_r^0 be the present woodland area that would exist if preservation goals were implemented. Subscript r is needed to differentiate the previous considered landscape levels from current levels referred to risk of loss of forested areas. Z_r^1 represents woodland area that would exist «without» preservation measures. The equivalent surplus (*ES*) is the maximum amount of money that the consumer would be WTP to secure Z_r^0 or avoid the deterioration of these woodlands. The *ES* contains the exchange between money income (Y) and availability of woodland. Formally, we can write the change as:

$$U_r(p, Y\text{-}ES, Q^0, Z_r^0) = U_r(p, Y, Q^0, Z_r^1)$$

where $U_r(.)$ is the utility function.

The WTP in order to avoid the deterioration of these woodlands, measured as Equivalent Surplus, is also given by the difference between the levels of expenditure, that is:

$$ES = e(p, Z_r^0, Q^0, U_r^1) - e(p, Z_r^1, Q^0, U_r^1) = -\int_{Z_r^0}^{Z_r^1} \frac{\partial e(p, U_r^1, Q^0, Z_r)}{\partial Z_r} dZ_r$$

Secondly, let us assume the possibility of reforesting barren areas which means a woodland area increasing from Z_r^0 to Z_r^2. To ensure the reforestation and change from Z_r^0 to Z_r^2 the individual would give up income to reach original utility level, that is:

$$U(p, Y, Q^0, Z_r^0) = U(p, Y\text{-}CS, Q^0, Z_r^2)$$

where *CS* is the monetary value of a change from initial situation to another with reforestation of barren areas.

The WTP to increase forested areas, in order to ensure their preservation, is the difference between the two levels of expenditure to achieve the utility level U_r^0, i. e.:

$$CS = e(p, Q^0, Z_r^0, U_r^0) - e(p, Q^0, Z_r^2, U_r^0) = -\int_{Z_r^2}^{Z_r^0} \frac{\partial e(p, U_r^0, Q^0, Z_r)}{\partial Z_r} dZ_r$$

II.3 — The survey

We estimate the measures of value shown above doing a CV study. Prior to trying to elicit WTP, respondents were asked their opinion about the use of common resources for woodlands (devote more private resources to improve woodlands, devote more private resources to maintain the current situation, no devote more private resources to maintain the current situation even forsaking

recreational activities and finally reduce common resources devoted to woodlands and their quantity and/or quality), so that they could begin thinking about their preferences and budget constraints. Respondents were then asked to consider the hypothetical scenarios.

The interviewees were first asked about a scenario of WTP in order to continue to use the PNA. Once their first WTP was elicited they were asked about their willingness to pay in the case hardwoods were to prevail in the park. The presentation of «improved landscape for the visitors» deriving from such a prevalence of hardwoods was made by showing pictures of hardwood landscapes in different seasons through the year. Finally, the last scenario asked about the willingness to pay for the preservation of woods that are not visited, by subjecting them to protective measures in the cases where there is tree cover and to reforestation where barren.

The question of how much an individual would be WTP in order not to give up visiting under the current circumstances, or with improved landscape, was followed by another question where emphasis was placed on either forsaking visits if an entrance fee were to be greater, or up to what extent would visitors be willing to pay. Thus, we intended the interviewees to establish their maximum WTP.

We conducted 402 Personal interviews. In order to obtain a conservative design we used WTP, following the recommendations of the NOAA report on CV (Arrow et al., 1993) (Willis, 1995), as well as open-ended questions ([1]). In order to reduce the chances of zero response we used a payment card proposing several values. The format chosen for the payment card was made following a requirement whereby the values displayed would not induce differences in the probability of choosing any such values. We needed two pre-tests of 25 subjects in order to obtain the final version of the survey instrument. In this process we pretested the wording of the questionnaire, the photographs and other aspects of the constructed market such as the payment vehicle, the environmental change to be valued and the information content of the market design. We avoided taking only certain types of visitors into account, with specific characteristics, such as crowds during holiday periods: summer and Easter; Sundays or certain hours of the day when there may be more visitors visiting the park. Thus, the interviews were made between June 1994 and June 1995: 153 during Spring and Autumn, 26 in Winter and 223 in Summer, on different days of the week and times of the day.

([1]) Although the NOAA Panel recommends the binary or closed format of the «conservative design» group, other authors find the open format to be even more conservative (Walsh et al. 1989) (Kriström, 1993) (Mitchell and Carson, 1995) (Kriström and Riera,1997).

III — Results

Out of the population interviewed, 81% accepted to answer to the questionnaire and out of these, 0.4% did not do so fully. To the first question (value of the visits made to natural park), 15.7% gave a zero value. However, only 19% may be admitted as being true zero value (that is, preferring to give up visiting rather than to pay an entrance fee). To the question relating to a landscape of hardwoods, 33% give a positive answer whereas 49% would not be willing to pay more than the WTP given to continue to use the park. To the questions referring to the last scenario (Benefits to the visitors to the park from implementing conservation measures), zero values were given by 31% and 29%, respectively.

TABLE 1

Willigness-to-pay responses (WTP) (pts)

	Visits	Landscape imp.	Conservation	Reforestation
Mean	382	71	1,733	1,468
Std. dev.	453	258	2,925	2,594
Median	250	0	1,000	1,000
95 % C. I.	337-426	45-96	1,446-2,020	1,214-1,722
5 % trimmed	324	32	1,244	1,041

C.I. stand for confidence interval.

(*) 5 % trimmed mean with the 5% largest and 5% smallest values.

The average willingness to pay to access the natural park amounts to 382 pesetas (pts) and with improved landscape the average value is 71 pts more. In order to implement preservation measures, visitors would be willing to pay up to 1,733 pts/year, and 1,468 pts/year for reforesting.

Aggregation of individual WTP's amounts in all three cases (continue to use the natural park, landscape improvement and implementing conservation measures) over the whole visitors to the NPA can be done in various ways (Loomis, 1987. We use the called «no-adjustment» approach where the sample are considered representative for the whole population. This approach is justified if the statistical distribution of factors influencing WTP in the sample corresponds to the distribution in the population as a whole. The use of this approach seems to be defensible because the questionnaire where randomly assigned between visitors). For the first WTP (continue to use the natural park) yields an aggregated WTP for visitors of 43 million pts/year or 58,000 pts/ha/year. The elevation of the WTP of the overall visitors to the park for improved landscape adds up to 6 million pts/year or 8,000 pts/ha/year. Visitors add up to 14,000 pts/hectare/year or 225 million pts/year to conserve or reforest one ha wood-

land. When speaking of the benefit to visitors ensuring the woodlands' survival (conservation and reforestation), the recreational use or a landscape improvement we only include visitors to the NPA. However individuals who, without actually visiting the NPA forest, do obtain some benefits.

III.1 — Factors affecting individual willingness to pay

To investigate possible determinants of individuals' WTP, bid curve estimations were carried out. Variables were included if there were strong a priori reasons for believing that they might have an affect on WTP (dependent variable) and if statistically significant correlations were found between those variables and WTP following a correlation analysis. A large percentage of respondents did not answer the landscape improvement and preservation measures (conservation and reforestation) questions. We do not know whether the zero values are true zero or protest responses. Because of the two problems ([2]) we use Heckman's two-stage estimation procedure ([3]) correcting the sample selectivity bias. Using probit estimation in the first stage we find out what characteristics of the visitors may determine the non-positive WTP:

$$Prob\,[non - positive\ WTP] = 1 - \Phi(\gamma M)$$

where Φ (.) is the std. normal distribution function, γ the vector of parameters to be estimated and M the vector of exogenous variables (characteristics of the visitors).

In the second stage we use the Mill's ratio from the probit residuals to estimate the following equation to fit the declared WTP:

$$WTP = \alpha M + \beta\lambda + \mu$$

where λ is the inverse Mill's ratio, M is the vector independent variables (socio-economic characteristics of the visitors), α and β the parameters to be estimated and μ the error term.

([2]) If we are to exclude some answers with criteria established by the researcher, such as all or some of the lacking answers, the remaining cases may not be interpreted as a random sampling of the population but as a selection where only the positive results are represented. If an OLS estimate were to be made of the relevant parameters, it would be biased and inefficient. There is the problem especially of an explanation variable being significant although this only means that certain observations may be censored (Heckman, 1976; Greene, 1993).

([3]) This is a type of tobit model (Amemiya, 1973) (Maddala, 1983). The tobit model allows to analyse both the binary qualitative decision: to buy or not to buy recreational use, as well as the quantitative dependency towards willingness to pay (Blundell and Meghir, 1987).

For entrance fee to continue to use the NPA WTP, the variables no devote more private resources to maintain the current situation even if it implies forsaking recreational activities and visits to other recreational sites were found to be statistically significant at the 1% level in the Heckman´s first stage.

Prob {non-positive response} =
1 — Φ [— 1.1 — 0.72 no devote more private resources to maintain the current situation (1 = yes, [0.00]
0 = no) + 0.59 other recreational sites (1 = other sites, 0 = only the NPA) [0.00]]
P-values in square brackets [ ]

Time spent per visit on the NPA, correction of the first WTP and spent the night before away from home are statistically significant at the 1%, 1% and 5% level in the Heckman´s second stage, respectively.

WTP {to continue to use the NPA} =
205.5 + 1.6 time spent per visit on the NPA [0.10]
+ 5.4 correction of the first WTP
(1 = individual corrects first WTP, 0 = induvidual who does not correct) [0.00]
+ 3.29 spent the night before away from home [0.00]
— 189.7 I (inverse Mill's ratio) [0.20]
R^2 adjusted = 8.7 %
P-values in square brackets [ ]

The inverse Mill's ratio is not significant. The reason could be the relatively small percentage of respondents who did not answer a positive WTP (15.7 %).

For landscape improvement in the NPA WTP, the variables: spent the night before away from home, and devote more private resources to improve woodlands were found to be the explanatory in the Heckman´s first stage.

Prob {non-positive response} =
1 — Φ [— 0.63 — 0.34 spent the night before away from (1 = yes, 0 = no) [0.05]
+ 0.41 devote more private resources to improve woodlands (1 = yes, 0 = no) [0.00]]
P-values in square brackets [ ]

Time spent per visit on the NPA, correction of the first WTP and spent the night before away from home are statistically significant at the 1%, 1% and 5% level in the Heckman´s second stage, respectively.

WTP {to improve landscape in the NPA} =
593 + + 24.1 time spent per visit on the NPA [0.10]
+ 2.7 Houshold income per capita [0.10]
+ 185.0 spent the night before away from home [0.00]
— 585.5 λ (inverse Mill's ratio)[0.01]
R^2 adjusted = 14.3 %
P-values in square brackets [ ]

For the implementation of preservation WTP, the variables devote more private resources to improve woodlands and individuals above the age of 40 are statistically significant at the 5% and 1% level in the Heckman´s first stage, respectively.

Prob {non-positive response} =
1 — Φ [0.52 — 0.28 individuals above the age of 40 (1 = yes, 0 = no) [0.04]
+ 0.24 devote more private resources to improve woodlands (1 = yes, 0 = no) [0.00]]
P-values in square brackets [ ]

Only the variable Spent the night before away from home were found to be a significant explanatory variable in the Heckman´s second stage.

WTP {to preservation} =
4829.6 + 1130.8 spent the night before away from home [0.01]
+ 7.5 Household income per capita [0.12]
— 6670.7 λ (inverse Mill's ratio) [0.00]
R^2 adjusted = 0.06 %
P-values in square brackets [ ]

For the reforestation of barren areas WTP, the variables devote more private resources to improve woodlands and individuals above the age of 40 were found to be the explanatory variables at the 5% and 1% level in the Heckman´s first stage.

Prob {non-positive response} =
1 — Φ [0.55 — 0..26 individuals above the age of 40 (1 = yes, 0 = no) [0.05]
+ 0.42.devote more private resources to improve woodlands (1 = yes, 0 = no) [0.00]]

Only Household income per capita were found to be a significant explanatory variable in the Heckman´s second stage.

WTP {to reforest} =
3908.4 + 878 spent the night before away from home [0.13]
+ 13.9 Household income per capita [0.04]
— 5502.5 λ (inverse Mill's ratio) [0.00]
R^2 adjusted = 0.06 %
P-values in square brackets [ ]

The estimated parameters show the expected signs. The value for R^2 adjusted in the last two cases is very low and only one variable is statistically significant. It can be expected that many features or behaviours of the interviewees, not included in the questionnaire, determine the WTP contributing towards such R^2 values. These factors may be in line with the preservation of the environment, such as the use of environmentally friendly products or their participation in «green» associations. The adjusted R^2 for landscape improvement

lies close to the 0.15 suggested for CV studies by Mitchell and Carson (1989) and consequently, it would be difficult to claim that respondents answer random numbers to the WTP questions.

IV — Discussion

Several valuation studies of woodlands recreational use have been undertaken in Spain (Kriström and Riera, 1997) and Europe. Our findings differ from Spanish applications (table 2) where the object assessed is usually a national or natural park with strong uniqueness, far away from urban centres and low density in visits. The obtained value per visit is the lowest of all studies in Spain. In terms of value per ha, only the application of Pérez and Barreiro (1997) is higher and the study of Pérez et al. (1995) lies close. The small size of the park as compared to the number of visitors explains why the values obtained were higher per ha than other applications with higher values per visit. The mentioned studies of Pérez and Barreiro (1997) and Pérez et al. (1995) are the exceptions. In the first one because there are also visits during the winter for sport purposes. The reason in the second one is the small size of the park but after all more than three times the NPA.

TABLE 2

Some forest recreational use valuations in Europe

Studies	Value per visit (pts)	Value per ha (pts)	Visits/ha (number)
Spain:			
Riera et al. (1994)	1,083	n.a.	n.a.
Leon (1995)	1,365	16,700	71
Pérez et al. (1995)	760	41,000	55
Campos et al. (1996)	1,328	1,150	n.a.
Del Saz (1996)	590	19,700	33
Pérez and Barreiro (1997)	1,134	59,000	45
Reboledo and Pérez (1994)	1,479	n.a.	n.a.
González Gómez (1997)	382	41,500	110
Germany and Switzerland:			
Nielsen (1991)	370	73,000	200
Löwenstein (194)	383	n.a.	n.a.
Elssesser (1996)	< 737	3,000,000	1,463
United Kingdom:			
Willia et al. (1988)	460-850	65,000-14,700	109-29
Willis and Benson (1989)	400-930	119,425-280	297-0.3
Bennet (1995)	211	83,400	396

n.a.: non-available.

Our results per visit are closer to some British and Central European studies (211, 370, 383, 400 and 460) which analyse recreational use of forests near urban centres, without natural uniqueness and a high number of visits per ha/year (Nielsen, 1991; Willis at al., 1988; Willis and Benson, 1989; Elsesser, 1996). Because of the high number of visits per ha and the small size, the recreational value per ha is higher than ours. At the same time in Great Britain valuations for forest with lower density of visits, without uniqueness and far away from urban centres were carried out. The estimated recreational values per visit are about 1,000 pts. The value per ha and the number of visits per ha lies under our values (Willis and Benson, 1989; Willis et al., 1988). The results from Löwenstein (1994) are close to ours in terms of visit (383 pts). The visitors are from far away but they stay long time in the district and make in average over 18 visits. A total of 3.2 million visits take place during the year (winter sport and health resort) and although we do not know the ha of the district the total value per ha is high and seems to be like an urban forest

Cost-benefit analysis

The net effects of policy measures on human welfare can be evaluated comparing their costs and benefits. A total maintenance cost of 23,000 pts/ha/year for the natural park have been calculated by González Gómez (1997) of which the public exchequer assume 22,000 pts/ha/year. A calculation using the aggregated mean WTP estimate from the study of 382 pts (58,000 pts/ha/year) gives a cost-benefit ratio of 1:2,6. Thus, based on the outcome of this application, a cost-benefit analysis indicates that current policy in the natural park is efficient. However, the 22,000 pts/ha/year may hardly be ascribed totally to the non-market output. According to a study made for the Federal Republic of Germany (Bartelheimer, 1993) the greatest costs incurred by a forest farm and the least income associated to the recreational function amount to a maximum of 44 DM/ha (3,500 pts). In the United Kingdom (Forestry Commission, 1992), maintenance costs to sustain access to the forests generates a cost of approximately 27£/ha (5,100 pts).

This difference in cost coincide with the fact that owner only have a total annual cost of 1,000 pts/ha/year when the average cost calculated with data from Ruiz-Urrestarazu (1992) for a maritime pine-eucalyptus forest is of 8,800 pts/ha/year. The timber related revenues obtained by owners are similar to those of the remaining 20,000 ha forest in the district. There are no possible alternative explotation such as housing development given that law prevents the privatisation of common woodlands ([4]) except for reasons of public interest and the

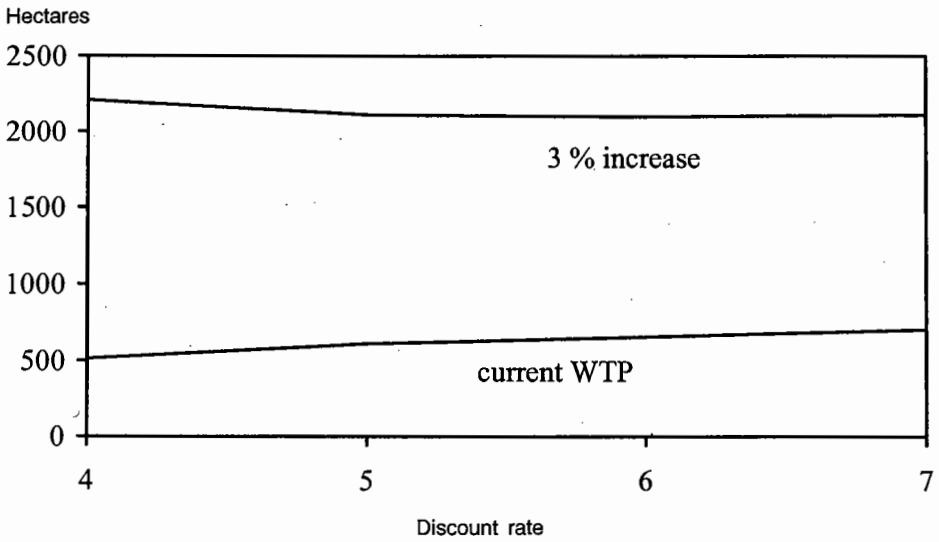
([4]) Law 13/1989 of October 10, governing common ownership of woodlands.

park also has free roaming horse and bovine cattle, as it is the case for other forests in the district. Thus, the natural park does not imply opportunity cost for owners and cost difference is not justified. From this cost side perspective there are reasons to assess the current policy in the natural park as inefficient. If the owners were compensated for their opportunity cost, the cost benefit ratio would be higher than 1:2.6.

Policy making is concerned with making changes from where we currently stand. The estimated values for a landscape improvement in the natural park and reforestation and conservation allow to evaluate possible changes. For instance, we analyse the possibility of substituting the current dominant specie (maritime pine) for oak maintaining the net present value of profit that owner currently obtain. We take the data from Ruiz-Urrestarazu (1992). In order to know how many ha of maritime pine could be substituted for oak during an oak rotation period (this corresponds to two maritime pine rotation periods, each of 35 years) we simulate results under different discount rates and increases in WTP (graph 1). The estimated value for visitors derived from landscape improvement is only considered from the year 22 to 70 of the whole oak rotation period. If current WTP were maintained for the period, that is to say, adding 8,000 pts/ha/year to the net revenues obtained for a oak forest from the year 22 to 70, we could substitute 510 ha from the natural park, maintaining the net present values of profit that owners would make with maritime pine under a discount rate of 4%. If the discount rate were of 5% the substituted ha would be 610 and 700 for a 7% discount rate. If the estimated WTP (8,000 pts/ha/year) would increase yearly at a 3% rate we could substitute more then the current natural park area: 1,700 ha (4% discount rate) 1,500 ha (5% discount rate) 1,450 ha (6% discount rate) and 1,410 (7% discount rate).

GRAPH 1

Replaceable area



The interest rate of return

The interest rate of return (IRR) represents the interest rate at which the present value of revenues equals the present value of costs. This rate is used to determine if a project (public or private) is acceptable by comparing it to a minimum rate of return: alternative investment opportunities for private capital and fixed rates for public forest investment projects ([5]).

TABLE 3

IRR and non-market output in the natural park

Scenario	species composition and non-market output	IRR (%)
Current scenario	20 % eucalyptus 80 % maritime pine	3.2
Recreational use	20 % eucalyptus 80 % maritime pine 58,000 pts/ha/year after the 22 rotation year	5,6
Landscape improvement	5 % eucalyptus 20 % maritime pine 75 % oak 8,000 pts/ha/year after the 22 rotation year	3.0

If we consider the current situation in the natural park of about 20% eucalyptus and 80% maritime pine, the internal rate of return is 3.2 %. As shown in table 3, by adding 58,000 ptas/hectare, which correspond to the recreational use value of the natural park, the internal rate of return increases up to 5,6 %, maintaining the same species composition (80% maritime pine and 20% eucalyptus). Considering a landscape improvement derived from substituting 15% of the current 20% eucalyptus area for oak and decreasing the participation of maritime pine from current 80% to 20% by substitution for oak, the internal rate of return would be 3.0 %. The IRR also changes when non-market output in non-visited forest is taken into account (14,000 pts/ha/year). We add the 14,000 pts/ha/year to the market net revenues for oak, maritime pine and eucalyptus. In this case and as it is shown in table 4, the IRR goes from 1.4%

([5]) The Forestry Commission in Britain uses a target rate of return of 3% to evaluate forestry projects. In the United States the Forest Services use a target rate of return of 4%.

to 2.9% for maritime pine, 1.6% to 3.8% for oak and 7.7% to 9.1% for eucalyptus.

TABLE 4

IRR and non-market output in the woodlands of the district

Specie	IRR for timber (%)	IRR including conservation (*) (%)
Maritime pine *(Pinus pinaster)*	1.4	2.9
Eucalyptus *(Eucalyptus globulus)*	7.7	9.1
Oak *(Quercus robur)*	1.6	3.8

(*) Conservation = preservation measures + reforestation (14,000 pts/ha/year for the total rotation period).

V — Conclusions

The purpose of this exercise was to obtain forest policy useful information (whether benefits outweigh costs) for Galicia or Northern Portugal. The forest reality in this two regions is very specific (Meixide Vecino and Pousa Hernandez, 1997) (Portela 1997) (CESE, 1996): only 50 per cent of the potential woodlands are cover by trees and the rest is open space without environmental or other objectives. Eucalyptus and pine plantations are nearly the only types of productive woodlands. On the other hand there are a small area where the priority is the survival of environmental assets, including the recreational-landscape uses, that relate to small «islands» of forest offered voluntarily by private owners or that are taken care of by the Administration under the figure of Natural Parks or similar (in Galicia under 1% of the whole territory). An attempt has been made to provide a conservative estimate of the public benefits of maintain woodlands and improve it. The contingent valuation was considered a appropriate method to do this.

Visitors support public intervention directed towards the promotion of forested areas, such as expanding existing areas or implementing measures that may guarantee favourable discrimination towards species that improve and diversify the landscape allowing for compatible recreational use thereof. Thus, if individuals were to decide the resources to be devoted to such purposes, there would be less need for spaces for recreational use and more diversity in the landscape.

The park's output value without the market is considerably higher than that of timber: 58,000 pts/ha/year against 16,000 pts/ha/year. The willingness to pay for the preservation of forests in the Baixo Miño is also higher than the earnings from sale of timber. The return rates for forest investment increase considerably if we consider the output generated by public assets.

There are other options for public intervention that seek to potentiate the supply of positive external effects: this may assume the shape of creating markets where they do not exist by charging a fee to access the forest for recreation--landscape use, also by limiting owner use, and also to subsidise costs or loss of revenues (Whitby, 1997) due to devoting the woods to social functions. In order to implement such tools the findings in this study provide some relevant information that should be expanded with other studies in other districts with different typology, inside the singular forest situation of Galicia and Northern Portugal.

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